

All cells release energy.

All cells must have energy to function. Glucose and other sugars are cell food—they are the power source for cell activities in almost all living things. When glucose is stored as glycogen or taken in as starch, it must be broken down into individual sugar molecules before cells are able to use it. Chemical energy is stored in the bonds of sugars. When a sugar molecule is broken down, a usable form of energy is released for the cell's life functions.

Cells can release energy in two basic processes: cellular respiration and fermentation. Cellular respiration requires oxygen, but fermentation does not. In addition, cellular respiration releases much more usable energy than does fermentation.



What is released when a sugar molecule is broken down?

Cellular Respiration

In **cellular respiration**, cells use oxygen to release energy stored in sugars such as glucose. In fact, most of the energy used by the cells in your body is provided by cellular respiration.

Just as photosynthesis occurs in organelles called chloroplasts, cellular respiration takes place in organelles called mitochondria. Remember that mitochondria are in both plant cells and animal cells, so both kinds of cells release energy through cellular respiration.

Like photosynthesis, cellular respiration is a process that changes starting materials into new products.

- ➊ **The starting materials** of cellular respiration are sugars—such as glucose—and oxygen.
- ➋ **The process** begins when glucose in the cytoplasm is broken down into smaller molecules. This releases a small amount of energy. These molecules then move into the mitochondria. At the same time, oxygen enters the cell and travels into the mitochondria. As the smaller molecules are broken down even further, hydrogen is released in a way that allows cells to capture energy in a usable form. The hydrogen combines with oxygen to make water.
- ➌ **The products** are energy, carbon dioxide, and water.

Some of the energy released during cellular respiration is transferred to other molecules, which then carry the energy where it is needed for the activities of the cell. The rest of the energy is released as heat. Carbon dioxide formed during cellular respiration is released by the cell.



What are the three products of cellular respiration?

READING TIP

Reread step 2 to make sure you understand what happens to oxygen and glucose.